Chamberlain Creek Spring Chinook Salmon Population

The Chamberlain Creek Chinook population (Figure 1) is part of the Snake River Spring/Summer Chinook ESU which has five major population groupings (MPGs), including: Lower Snake River, Grande Ronde / Imnaha, South Fork Salmon River, Middle Fork Salmon River, and the Upper Salmon River group. The ESU contains both spring and summer run Chinook. The Chamberlain Creek population is a spring run and is one of nine extant populations in the Middle Fork Salmon River MPG.

The ICTRT classified the Chamberlain Creek population as an "intermediate" population (Table 1) based on historical habitat potential (ICTRT 2005). Due to core area considerations, however, this population may be treated as "basic" for abundance and productivity criteria. A chinook population classified as basic has a mean minimum abundance threshold criteria of 500 naturally produced spawners with a sufficient intrinsic productivity to achieve a 5% or less risk of extinction over a 100-year timeframe.

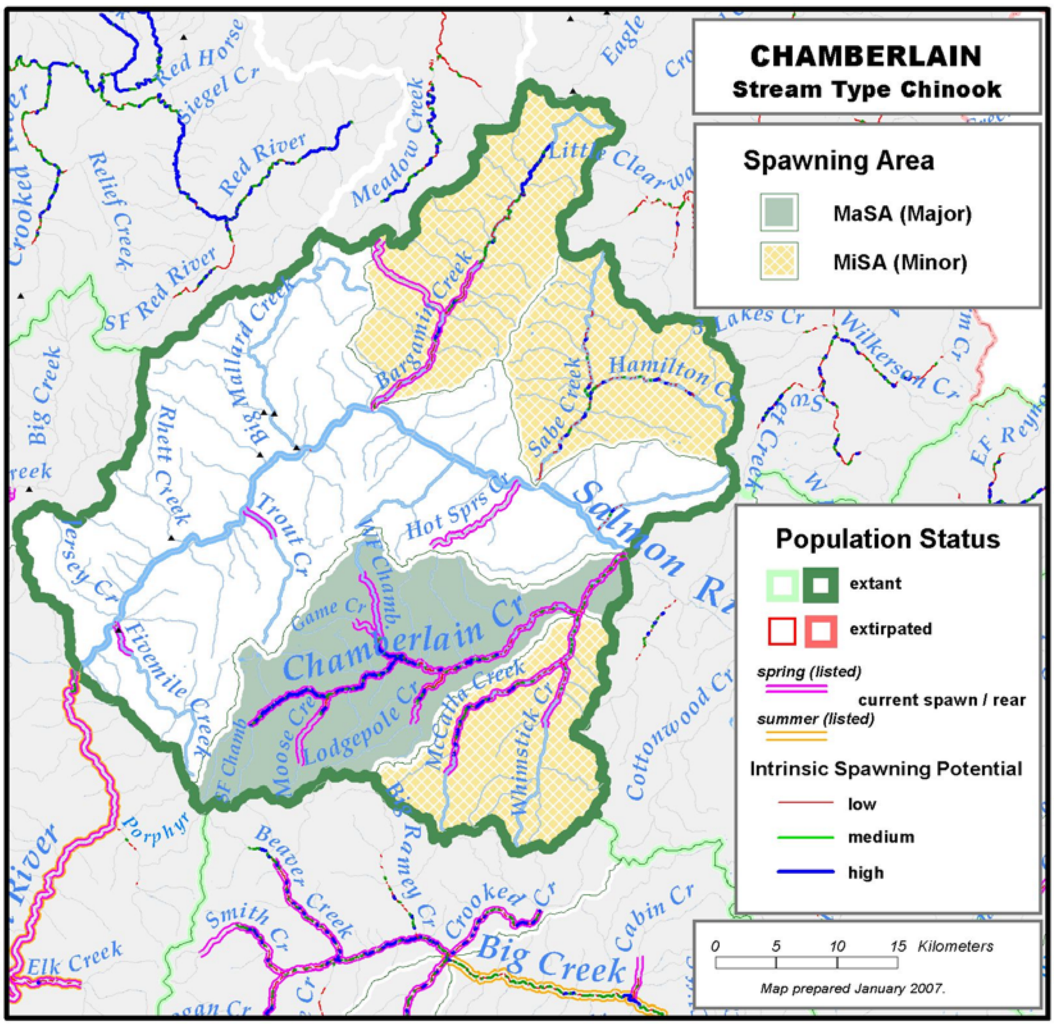

Figure 1. Chamberlain Creek Spring Chinook salmon population boundary and major (MaSA) and minor (MiSA) spawning areas.

Table 1. Chamberlain Creek Spring Chinook salmon population basin statistics and intrinsic potential analysis summary.

Drainage Area (km2)	2,109
Stream lengths km (total)a	840
Stream lengths km (below natural barriers)a	431
Branched stream area weighted by intrinsic potential (km2)	0.163
Branched stream area km2 (weighted and temp. limited)[b]	0.163
Total stream area weighted by intrinsic potential (km2)	0.329
Total stream area weighted by intrinsic potential (km2) temp limited[b]	0.329
Size / Complexity category	Inter.[c] / “D” (core drainage & adj. tribs)
Number of Major Spawning Areas	1
Number of Minor Spawning Areas	3

[a]All stream segments greater than or equal to 3.8m bankfull width were included

[b]Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22°C

[c]This population may be treated as a “basic” sized population with regard to abundance and productivity criteria due to core area considerations

Current Abundance and Productivity

Current (1985 to 2003) natural abundance (number of adult spawning in natural production areas) has ranged from 13 in 1998 to 686 in 2003 (Figure 2). Annual abundance estimates for Chamberlain Creek were based n expanded redd counts. IDFG has consistently surveyed two index reaches within the Chamberlain Creek drainage for spring and summer chinook spawning (IDFG #1-a and WS-1). We summed the annual counts across index areas and applied two expansion factors to generate estimated annual spawner numbers. The first expansion factor was the ratio between an estimate of the total weighted spawning area currently accessible in the population, and the weighted amount of spawning area within the index count reaches. The index areas represented approximately 16% of the total weighted core area (207,811 m^2) currently identified as being in use for spawning. We also applied the Middle Fork average fish per redd (1.82) to generate estimated spawners (Table 5). The resulting total expansion factor was 11.45.

For the return per spawner analyses, we did not include data pairs in which the parent spawner estimate was five or less.

Recent year natural spawners include returns originating from naturally spawning parents; no hatchery strays have been observed in the population. Spawners originating from naturally spawning parents have comprised an average of 100% since 1985 (Table 2).

Abundance in recent years has been highly variable, the most recent 10-year geomean number of natural origin spawners was 223 (Table 2). During the period 1985-1998, returns per spawner for chinook in the Chamberlain Creek population ranged from 0.15 (1990) to 75.8 (1998). The most recent 20 year (1978-1997) SAR adjusted and delimited (at 75% of the size threshold) geometric mean of returns per spawner was 2.09 (Table2).

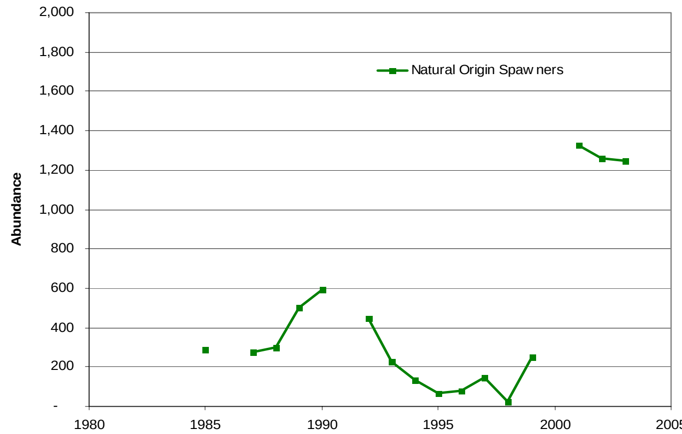

Figure 2. Chamberlain Creek Spring Chinook salmon population spawner abundance estimates (1985-2003.

Table 2. Chamberlain Creek Spring Chinook salmon population abundance and productivity estimates.

10-year geomean natural abundance	223
20-year return/spawner productivity	1.34
20-year return/spawner productivity, SAR adj. and delimited[a]	2.09
20-year Bev-Holt fit productivity, SAR adjusted	n/a
20-year Lambda productivity estimate	n/a
Average proportion natural origin spawners (recent 10 years)	1.0
Reproductive success adj. for hatchery origin spawners	n/a

[a]Delimited productivity excludes any spawner/return pair where the spawner number exceeds 75% of the size category threshold for this population. This approach attempts to remove density dependence effects that may influence the productivity estimate.

Comparison to the Viability Curve

- Abundance: 10-yr geomean natural origin spawners
- Productivity: 20-yr geomean R/S (adjusted for marine survival and delimited at 375 spawners)
- Curve: Hockey-Stick curve
- Conclusion: Chamberlain population is at **HIGH** risk based on current abundance and productivity. The point estimate resides below the 25% risk curve (Figure 3). Abundance and productivity estimates for this population should be viewed with caution due to a short time series with several data gaps.

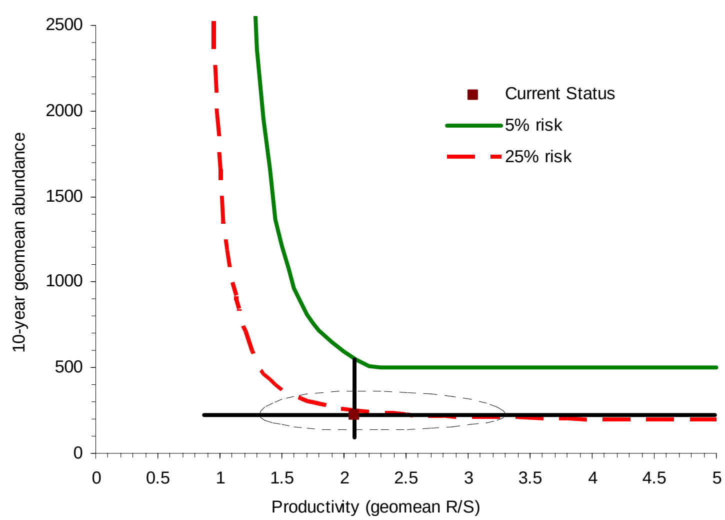

Figure 3. Chamberlain Creek Spring Chinook current estimate of abundance and productivity compared to the viability curve for this ESU. The point estimate includes a 1 SE ellipse and 95% CI (1.83 X SE abundance line, and 1.89 X SE productivity line).

Spatial Structure and Diversity

The ICTRT has identified one major spawning area (MaSA) and three minor spawning areas (MiSAs) within the Chamberlain Creek spring chinook population. There are no modeled temperature limitations within this MaSA. The core spawning areas for the population are within the Chamberlain Creek drainage, not the adjunct streams that are tributary to the Salmon River. The Bargamin and Sabe MiSAs are outside of the core population area. Spawning primarily occurs in Chamberlain Creek upstream of West Fork Chamberlain Creek and in West Fork Chamberlain Creek, reaches within the MaSA.

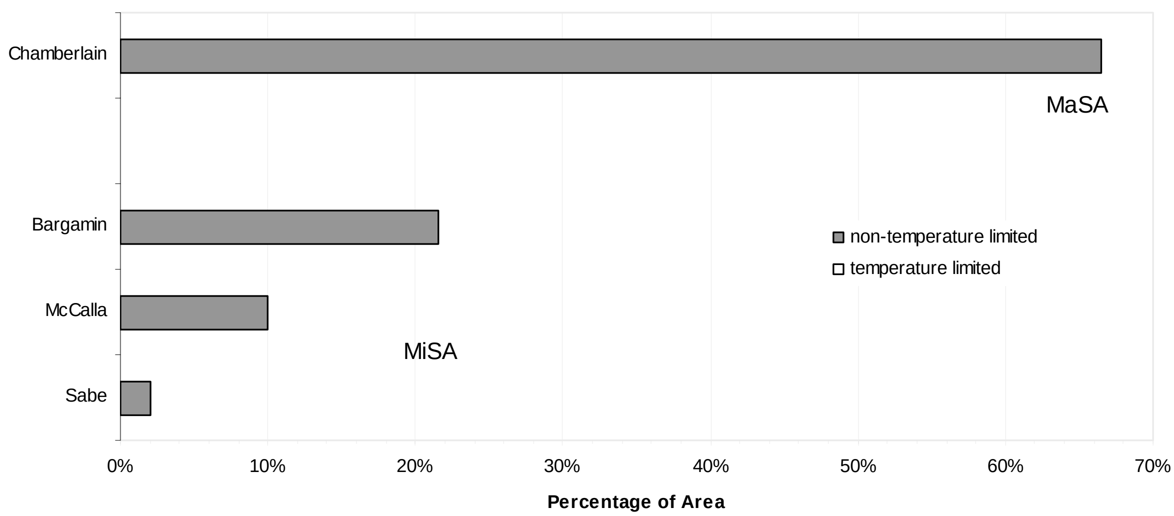

Figure 4. Chamberlain Creek Spring Chinook salmon population distribution of intrinsic potential habitat across major and minor spawning areas.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas.

Chamberlain Creek is an Intermediate-size population with "D" type complexity (core production area in one drainage plus adjunct tributaries outside of the core drainage). The adjunct tributaries enter the main Salmon River from the mouth of Chamberlain Creek downstream to just below the mouth of Fivemile Creek. The largest of the adjunct tributaries are Bargamin and Sabe creeks. The Chamberlain Creek population of spring Chinook salmon has one MaSA (Chamberlain) and three MiSAs (Bargamin, McCalla and Sabe). The total branched stream area weighted by intrinsic potential is 162,637m2. The total MiSA weighted area is distributed across the MiSAs as follows: Bargamin – 64%, McCalla – 30% and Sabe – 6%. The sum of the non-temperature-limited intrinsic potential area in the MiSAs is 55% of the minimum capacity of a MaSA. Since the total MiSA and MaSA area is 163% of the minimum for a MaSA, this metric is rated *Moderate Risk*, even though the sum of the MiSAs is not greater than 75% of capacity of a MaSA. The Moderate Risk rating seems reasonable based on the number (3) and spatial distribution of the MiSAs.

A.l.b. Spatial extent or range of population.

The IDFG has conducted annual spawner index counts since 1985 on Chamberlain Creek (mouth of the West Fork upstream to Flossie Creek) and West Fork Chamberlain Creek (mouth upstream to Game Creek). Since 1995 researchers from the USFS-Rocky Mountain Research Station have been surveying all potential spawning habitat in the basin. This metric is rated *Very Low Risk* because current spawning distribution mirrors historical and the historical range has not been reduced. The MaSA is occupied at both the lower and upper ends based on recent spawner surveys.

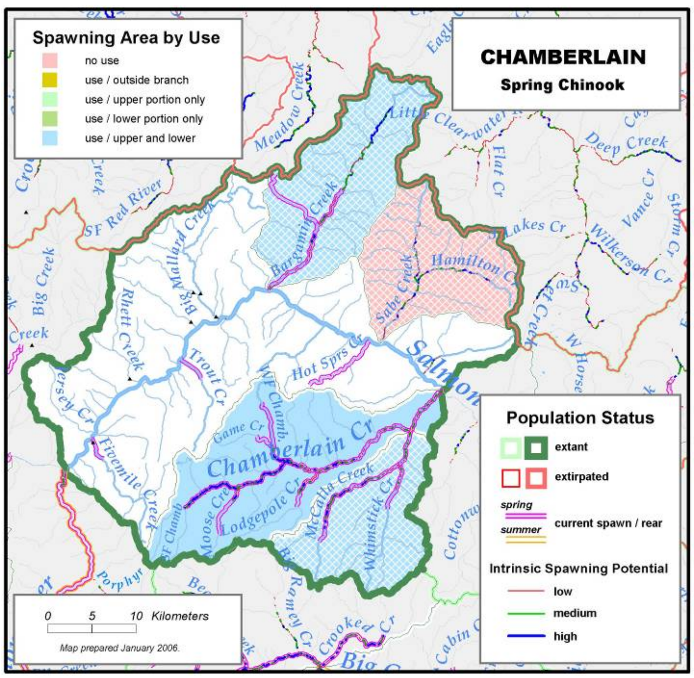

Figure 5. Chamberlain Creek Spring Chinook salmon population current spawning distribution and spawning area occupancy

A.1.c. Increase or decrease in gaps or continuities between spawning areas.

There has been no change in gaps when comparing current and historical spawning distribution. The population is rated at *Low* risk because the historical MaSA is occupied, gap distance and continuity have not changed, and there has been no increase in distance between this population and other populations in the MPG or ESU. The Bargamin and McCalla MiSAs are occupied, will Sabe is not. This metric cannot achieve a Very Low risk rating because there are not three or more historic MaSAs.

B.1.a. Major life history strategies.

There are limited data to allow any comparisons between historic and current life history strategies. The IDFG classifies adult spawners as spring run. The known major juvenile life history strategy is a spring yearling migrant. No natural or anthropogenic impacts that could have resulted in loss of a life history strategy are known to have occurred. It appears all historic juvenile and adult life history strategies are present, but because data is limited the metric is rated *Low Risk*.

B.1.b. Phenotypic variation.

There is no data to indicate that any phenotypic traits have been significantly changed or lost. No alterations of within-basin habitat conditions that could have resulted in loss of a phenotypic trait are known to have occurred. No major selective pressures exist which would cause significant changes in or loss of traits. Changes in the mainstem migration corridor (lower Snake and Columbia rivers) likely have altered timing of juvenile downstream passage and adult upstream passage. Because smolt entry into the estuary is substantially delayed relative to historic conditions, this metric is rated at *Low Risk.*

B.1.c. Genetic variation.

Genetic ratings were based on IC-TRT analysis of allozyme data presented in Waples et al. 1993. In addition, the IC-TRT analyzed WDFW and R. Waples, unpublished allozyme data, and P. Moran, unpublished microsatellite data. There is consistent temporal variation in the population and allele frequencies are clearly distinct from other populations. This metric was rated *Very Low Risk.*

B.2.a. Spawner composition.

Spawner composition is determined from spawning ground carcass recoveries. Any marked fish that are recovered are examined for the presence of a coded-wire or PIT tag. The entire Middle Fork Salmon River MPG is managed by the IDFG as a wild production area with no hatchery intervention. While carcass surveys have been conducted annually in many of the core spawning areas in the MPG, extremely few hatchery strays have been documented. Assessment of this metric is restricted to the observation of only hatchery strays.

(1) *Out-of-ESU spawners*. No out-of-ESU strays have been detected spawning in the population and this metric is rated *Very Low* risk.

(2) *Out-of-MPG spawners from within the ESU*. Potential out-of-MPG fish that could stray into this population would originate from hatcheries in the downstream South Fork Salmon River MPG or upstream Upper Salmon River MPG. An exhaustive review of all spawner carcass data has not been completed however, it is possible that one or two hatchery strays were present in the population across all survey years. The occurrence of that small number of strays is not suspected of increasing risk to the population and this metric is rated *Very Low* risk.

(3) *Out of population within MPG spawners*. There is no within-MPG hatchery program, and this metric is rated *Very Low Risk.*

(4) *Within-population hatchery spawners.* There is no within population hatchery program, and this metric is rated *Very Low* risk.

The overall risk rating for metric B.2.a "spawner composition" is *Very Low Risk* since the population and entire MPG are managed for wild production and essentially no hatchery strays have been observed spawning in the population.

B.3.a. Distribution of population across habitat types.

The Chamberlain Creek population intrinsic potential distribution historically was distributed across three EPA level IV ecoregions, with the Southern Forested Mountains being predominant (Table 3 and Fig. 6). There is one substantial change from historic to current distribution. The Hot Dry Canyons ecoregion is significantly more utilized now than historically. Because of the one substantial change this metric was rated *Moderate Risk* for the population. The change in representation of the Southern Forested Mountains ecoregion is not considered substantial because the change was less than 67%.

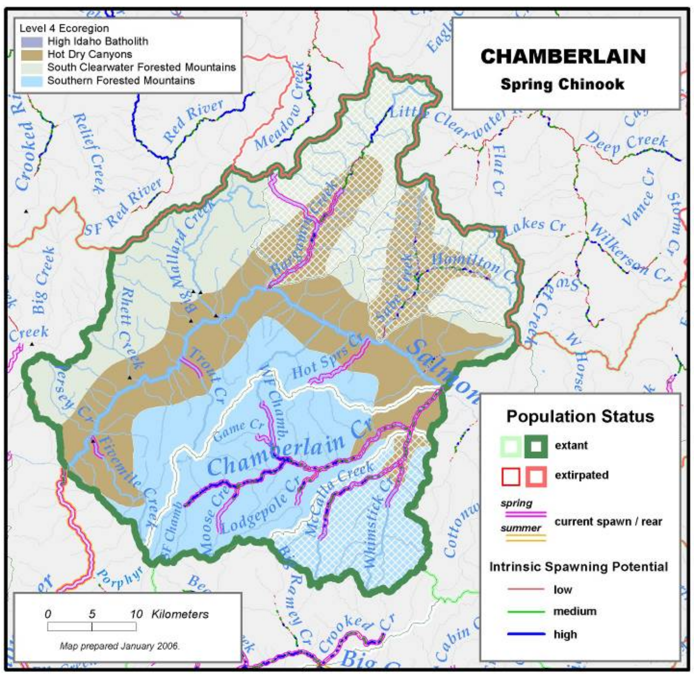

Figure 6. Chamberlain Creek Spring Chinook salmon population spawning distribution across EPA level 4 ecoregions.

Table 3. Chamberlain Creek Spring Chinook salmon population proportion of current spawning areas across EPA level 4 ecoregions.

Ecoregion	% of historical branch spawning area in this ecoregion (non-temperature limited)	% of historical branch spawning area in this ecoregion (temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
Hot Dry Canyons	9.5	9.5	39.2
South Clearwater Forested Mountains	14.1	14.1	0.0
Southern Forested Mountains	76.4	76.4	60.8

<u>B.4.a. Selective change in natural processes or selective impacts.</u>

Hydropower system: The hydrosystem and associated reservoirs impose some selective mortality on smolt outmigrants and adult migrants, the selective mortality is not likely to remove more than 25% of the affected individuals. The likely impacts are rated as *Low Risk* for this action.

Harvest: Recent harvest rates for spring/summer Chinook salmon are generally less than 10% annually. There are no freshwater fisheries directly targeting wild spring/summer Chinook salmon; indirect mortalities are expected to occur in some fisheries selective for hatchery fish. It is not likely that the incidental mortality is selective for a particular group of fish or if it is, it would not select 25% or more of that particular group, therefore this action was rated as *Very Low* risk.

Hatcheries: The proportion of hatchery strays has always been estimated as 0%. This selective impact was rated *Very Low Risk*.

Habitat: Habitat changes resulting from natural events or anthropogenic impacts may impose some selective mortality, but the extent is unknown. Habitat in the basin has been impacted by grazing activities, water diversions on tributary streams and naturally occurring forest fires. It is likely that any selective mortality imposed as a result of habitat alterations in the basin would impact a non-negligible portion of the population. This selective impact was rated *Very Low Risk*.

Spatial Structure and Diversity Summary

Overall spatial structure and diversity has been rated *Low Risk* for the Chamberlain Creek population (Table 4). A *Low* risk rating is the lowest risk level the population could ever achieve because of spatial structure constraints. Historically, the population only contained one MaSA.

Table 4. Chamberlain Creek Spring Chinook salmon population spatial structure and diversity risk rating summary.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	M (0)	M (0)	Low Risk (Mean=1)	Low Risk	**Low Risk**
A.1.b	VL (2)	VL (2)			
A.1.c	L (1)	L (1)			
B.1.a	L (1)	L (1)	Low Risk	Low Risk	
B.1.b	VL (2)	VL (2)			
B.1.c	VL (2)	VL (2)			
B.2.a(1)	VL (2)	Very Low Risk (2)	Very Low Risk		
B.2.a(2)	VL (2)				
B.2.a(3)	VL (2)				
B.2.a(4)	VL (2)				
B.3.a	M (0)	M (0)	Moderate Risk		
B.4.a	L (1)	L (1)	Low Risk		

Overall Viability Rating

The Chamberlain Creek spring/summer Chinook salmon population does not currently meet viability criteria because Abundance/Productivity risk is high (Table 5). The 20-year delimited recruit per spawner point estimate (1.49) is greater than replacement but substantially less than the 1.9 required at the minimum threshold abundance (even though it is an Intermediate size population, abundance/productivity is assessed using the viability curve for Basic size populations). The 10-year geometric mean abundance is only 45% of the minimum threshold abundance. Improvement in abundance/productivity status (reduction of risk level) will need to occur before the population can be considered viable. Also, the population currently does not meet the criteria for a "maintained" population, but has the potential to achieve the Highly Viable status since spatial structure/diversity risk is Low.

		Spatial Structure/Diversity Risk			
		Very Low	**Low**	**Moderate**	**High**
Abundance/ Productivity Risk	**Very Low** (<1%)	**HV**	**HV**	**V**	M*
	Low (1-5%)	**V**	**V**	**V**	M*
	Moderate (6 – 25%)	M*	M*	M*	
	High (>25%)		Chamberlain		

Figure 7. Chamberlain Spring Chinook salmon population risk ratings integrated across the four viable salmonid population (VSP) metrics. *Viability Key: HV – Highly Viable; V – Viable; M* – Candidate for Maintained; Shaded cells-- not meeting viability criteria (darkest cells are at greatest risk).*

Chamberlain Creek Spring Chinook – Data Summary

Data type: Redd count expansions
SAR: Averaged Williams/CSS series

Table 5. Chamberlain Creek Spring Chinook salmon population abundance and productivity data used for curve fits and R/S analysis. Bolded values were used in estimating the current productivity (Table 6).

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	SAR Adj. Factor	Adj. Rtns	Adj. R/S
1985	**286**	**1.00**	**286**	**493**	**1.72**	**1.6**	**773**	**2.70**
1986								
1987	275	1.00	275					
1988	**298**	**1.00**	**298**	**448**	**1.50**	**0.7**	**335**	**1.12**
1989	504	1.00	504	124	0.25	1.8	223	0.44
1990	596	1.00	596	91	0.15	4.7	425	0.71
1991								
1992	447	1.00	447	127	0.28	1.7	210	0.47
1993	**229**	**1.00**	**229**	**99**	**0.43**	**1.6**	**159**	**0.69**
1994	**137**	**1.00**	**137**	**151**	**1.10**	**1.0**	**157**	**1.14**
1995	**69**	**1.00**	**69**	**95**	**1.38**	**0.6**	**57**	**0.83**
1996	80	1.00	80					
1997	**149**	**1.00**	**149**	**1965**	**13.20**	**0.3**	**581**	**3.90**
1998	**23**	**1.00**	**23**	**1735**	**75.76**	**0.3**	**516**	**22.50**
1999	252	1.00	252					
2000								
2001	1329	1.00	1329					
2002	1260	1.00	1260					
2003	1249	1.00	1249					

Table 6. Chamberlain Creek Spring Chinook salmon population geometric mean abundance and productivity estimates (values used for current productivity and abundance are shown in boxes).

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1987-1998	1979-1998	geomean
Point Est.	2.99	2.89	1.84	$\boxed{2.09}$	n/a	n/a	$\boxed{223}$
Std. Err.	0.90	0.67	0.60	0.46			0.49
count	5	7	5	7			9

Table 7. Chamberlain Creek Spring Chinook salmon population stock-recruitment curve fit parameter estimates. Biologically unrealistic or highly uncertain values are highlighted in grey.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.34	0.76	n/a	n/a	1.09	0.82	46.0	1.38	0.50	n/a	n/a	0.78	0.63	36.7
Const. Rec	262	94	n/a	n/a	n/a	n/a	36.6	272	64	n/a	n/a	n/a	n/a	28.0
Bev-Holt	50.00	72.82	265	100	1.00	0.51	41.4	50.00	104.35	283	74	0.55	0.13	32.5
Hock-Stk	14.04	80.62	19	107	1.00	0.47	40.9	12.23	0.00	22	0	0.54	0.10	32.3
Ricker	11.44	7.38	0.00784	0.00197	0.97	0.49	40.8	4.19	2.10	0.00404	0.00153	0.70	0.30	35.7

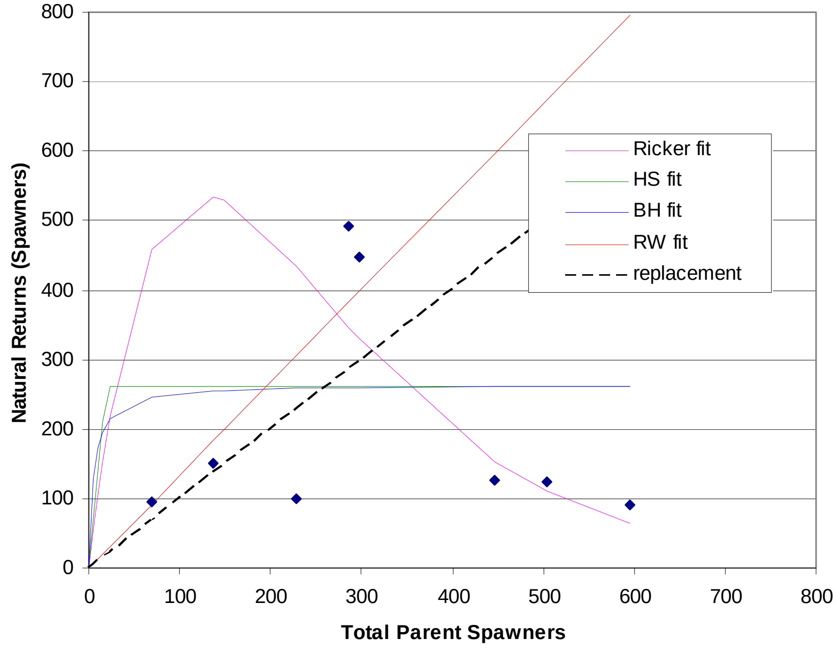

Figure 8. Chamberlain Creek Spring Chinook salmon population stock recruitment curves. Bold point were used in estimating the current productivity. Data were not adjusted for marine survival.

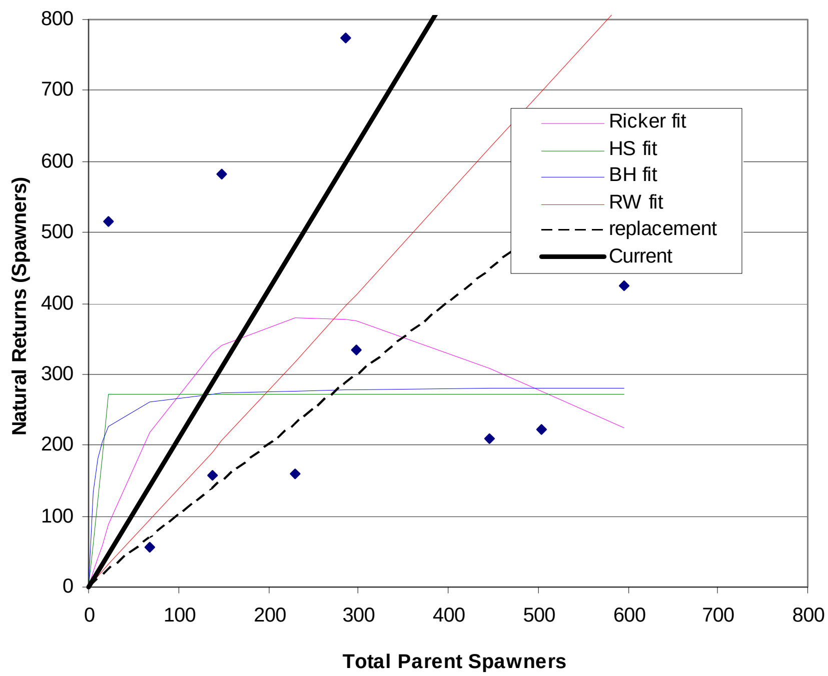

Figure 9. Chamberlain Creek Spring Chinook salmon population stock recruitment curves. Bold point were used in estimating the current productivity. Data were adjusted for marine survival.